

## What Is Claimed Is:

1           1.       A method for lightpath provisioning in a reconfigurable optical network  
2 comprising the steps of:

3           assigning an IP address to network addressable elements in said reconfigurable  
4 optical network;

5           determining current topology of said reconfigurable optical network;

6           determining current resources in said reconfigurable optical network;

7           maintaining information regarding a state of said reconfigurable optical network;

8           receiving a request to create a lightpath from a source;

9           selecting a route for data to be transmitted between said source and a destination  
10 based on said current resources of said reconfigurable optical network and said current  
11 topology of said reconfigurable optical network;

12           generating an API call to create a lightpath, said API call results in a message;

13           forwarding said message to each network addressable element along said selected  
14 route;

15           selecting an output channel at each node to be used as an input channel at a next  
16 node;

17           reconfiguring an OLXC an input channel at a current node connected to said  
18 output channel at said current node; and

19           receiving a response from said destination that said selected route is available.

1           2.       The method according to claim 1, wherein the assigning step further  
2 comprises the step of uniquely assigning said IP address to each network addressable

3 element used along said route through said reconfigurable optical network according to  
4 an OLXC from which said network addressable element is sourced.

1 3. The method according to claim 1, further wherein said uniquely assigned  
2 network addressable element may include one of a node, a channel and a link.

1 4. The method according to claim 1, wherein the assigning step further  
2 comprises the step of assigning a unique IP address to a non-IP aware client.

1 5. The method according to claim 1, wherein the assigning step further  
2 comprises the step of assigning a unique IP address to an OLXC port to which a non-IP  
3 aware client is attached.

1 6. The method according to claim 1, wherein said information regarding said  
2 state of said reconfigurable optical network is distributed throughout said reconfigurable  
3 optical network.

1 7. The method according to claim 1, wherein said information regarding said  
2 state of said reconfigurable optical network is maintained in a soft-state.

1 8. The method according to claim 1, further comprising the step of  
2 forwarding a control message from each IP router to configure each router's OLXC  
3 respectively in said allocated lightpath.

1 9. The method according to claim 1, further comprising the step of  
2 forwarding an acknowledgement from each IP router indicating that said IP router's  
3 respective OLXC has been configured.

1           10.    The method according to claim 1, further comprising the steps of:  
2           updating said current topology of said reconfigurable optical network; and  
3           updating said current resources of said reconfigurable optical network.

1           11.    The method according to claim 1, wherein information regarding said  
2           resources of said reconfigurable optical network and information regarding said topology  
3           of said reconfigurable optical network are distributed throughout said reconfigurable  
4           optical network.

1           12.    The method according to claim 1, wherein said current available resources  
2           of said reconfigurable optical network is determined by sending a probe message to  
3           determine available wavelengths along wavelength continuous routes.

1           13.    The method according to claim 1, wherein said probe message uses a  
2           wavelength availability vector equal to a number of said wavelengths on a first link of  
3           said selected route, said wavelength availability vector being marked at each link along  
4           said selected route indicating what wavelengths are available at each link along said  
5           selected route.

1           14.    The method according to claim 1, wherein said wavelength availability  
2           vector being returned to said first link once said selected route has been traversed.

1           15.    The method according to claim 1, further comprising the step of selecting  
2           from among the available wavelengths using an arbitrary wavelength assignment scheme.

1           16.    The method according to claim 1, further comprising the step of receiving  
2           a request to create a lightpath from an originator by a first-hop IP router if said first-hop  
3           IP router was not the source of said request to create a lightpath.

1           17.    The method according to claim 1, further comprising the step of  
2           forwarding said message using an IP router alert.

1           18.    The method according to claim 1, wherein the step of selecting a route for  
2           the data to be transmitted is performed by a first-hop router.

1           19.    The method according to claim 1, wherein the step of selecting a route for  
2           the data to be transmitted is performed by a pre-authenticated higher-level network  
3           management system.

1           20.    The method according to claim 1, wherein the step of determining current  
2           topology is performed via OSPF link state advertisement.

1           21.    The method according to claim 1, further comprising the step of carrying  
2           said selected route in an IP datagram using an IP source route option.

1           22.    The method according to claim 1, further comprising the step of carrying  
2           said selected route in packet payload.

1           23.    The method according to claim 1, wherein said selected route is specified  
2           as a series of nodes.

1           24.    The method according to claim 1, wherein said selected route is specified  
2           as a series of links.

1           25.    The method according to claim 1, wherein said selected route is specified  
2           as a series of nodes and links.

1           26.    The method according to claim 1, wherein said current topology and  
2           resources comprise:

3           a total number of active channels;  
4           a number of allocated channels;  
5           a number of preemptable channels;  
6           a number of reserved restoration channels;  
7           Shared Risk Link Groups throughout the reconfigurable optical network; and  
8           optional physical layer parameters for each link.

1           27.    A method for lightpath provisioning in a reconfigurable optical network  
2           comprising the steps of:

3           assigning an IP address to network addressable elements in said reconfigurable  
4           optical network;  
5           determining current topology of said reconfigurable optical network;  
6           determining current resources in said reconfigurable optical network;  
7           maintaining information regarding a state of said reconfigurable optical network;  
8           receiving a request to create a lightpath from a source;

9 selecting a route for data to be transmitted between said source and a destination  
 10 based on said current resources of said reconfigurable optical network and said current  
 11 topology of said reconfigurable optical network;  
 12 generating an API call to create a lightpath, said API call results in a message;  
 13 forwarding said message to each network addressable element along said selected  
 14 route;  
 15 selecting an output channel at each node to be used as an input channel at a next  
 16 node;  
 17 reconfiguring an OLXC an input channel at a current node connected to said  
 18 output channel at said current node;  
 19 receiving a response from said destination that said selected route is not available;  
 20 and  
 21 releasing resources configured along a partially created lightpath.

1 28. The method according to claim 1, wherein said response is accomplished  
 2 using an ICMP message.

1 29. The method according to claim 1, wherein said response is accomplished  
 2 using a CR-LDP message.

1 30. The method according to claim 1, wherein said response is accomplished  
 2 using a RSVP message.

1 31. A method for lightpath provisioning in a reconfigurable optical network  
 2 comprising the steps of:

3 naming each network addressable element in said reconfigurable optical network;  
4 determining current topology in said reconfigurable optical network;  
5 determining current resources in said reconfigurable optical network;  
6 requesting establishment of a lightpath; and  
7 allocating said lightpath.

1 32. A system for lightpath provisioning in a reconfigurable optical network  
2 comprising:

3 means for assigning an IP address to each network addressable element in said  
4 reconfigurable optical network;

5 means for receiving a request to create a lightpath from a source;

6 means for determining current topology of said reconfigurable optical network;

7 means for determining current resources in said reconfigurable optical network;

8 means for maintaining information regarding a state of said reconfigurable optical  
9 network;

10 means for selecting a route for data to be transmitted between said source and a  
11 destination based on said current resources of said reconfigurable optical network and  
12 said current topology of said reconfigurable optical network;

13 means for generating an API call to create a lightpath, said API call results in a  
14 message;

15 means for forwarding said message to each network addressable element along  
16 said selected route;

17 means for selecting an output channel at each node to be used as an input channel  
18 at a next node;

19 means for reconfiguring an OLXC an input channel at a current node connected to  
20 said output channel at said current node; and

21 means for receiving a response from said destination that said selected route is  
22 available.

1 33. The system according to claim 1, wherein the means for assigning further  
2 comprises means for uniquely assigning said IP address to each network addressable  
3 element used along said route through said reconfigurable optical network according to  
4 an OLXC from which said channel is sourced.

1 34. The system according to claim 1, further wherein said uniquely assigned  
2 network addressable element may include a node, a channel and a link.

1 35. The system according to claim 1, wherein said means for assigning further  
2 comprises means for assigning a unique IP address to a non-IP aware client.

1 36. The system according to claim 1, wherein said means for assigning further  
2 comprises means for assigning a unique IP address to an OLXC port to which a non-IP  
3 aware client is attached.

1 37. The system according to claim 1, wherein said information regarding said  
2 state of said reconfigurable optical network is distributed throughout said reconfigurable  
3 optical network.



1           38.    The system according to claim 1, wherein said information regarding said  
2 state of said reconfigurable optical network is maintained in a soft-state.

1           39.    The system according to claim 1, further comprising means for forwarding  
2 a control message from each IP router to configure each router's OLXC respectively in  
3 said allocated lightpath.

1           40.    The system according to claim 1, further comprising means for forwarding  
2 an acknowledgement from each IP router indicating that said IP router's respective  
3 OLXC has been configured.

1           41.    The system according to claim 1, further comprising:  
2 means for updating said current topology of said reconfigurable optical network;  
3 and  
4 means for updating said current resources of said reconfigurable optical network.

1           42.    The system according to claim 1, wherein information regarding said  
2 resources of said reconfigurable optical network and information regarding said topology  
3 of said reconfigurable optical network are distributed throughout said reconfigurable  
4 optical network.

1           43.    The system according to claim 1, wherein said current topology of said  
2 reconfigurable optical network is determined by sending a probe message to determine  
3 available wavelengths along wavelength continuous routes.

1           44.    The system according to claim 1, wherein said probe message uses a  
2 wavelength availability vector equal to a number of said wavelengths on a first link of  
3 said selected route, said wavelength availability vector being marked at each link along  
4 said selected route indicating what wavelengths are available at each link along said  
5 selected route.

1           45.    The system according to claim 1, said wavelength availability vector is  
2 returned to said first link once said selected route has been traversed.

1           46.    The system according to claim 1, further comprising means for selecting  
2 from among the available wavelengths using an arbitrary wavelength assignment scheme.

1           47.    The system according to claim 1, further comprising means for receiving a  
2 request to create a lightpath from an originator by a first-hop IP router if said first-hop IP  
3 router was not the source of said request to create a lightpath.

1           48.    The system according to claim 1, further comprising means for forwarding  
2 said message using an IP router alert.

1           49.    The system according to claim 1, wherein the means for selecting a route  
2 for the data to be transmitted is performed by a first-hop router.

1           50.    The system according to claim 1, wherein the means for selecting a route  
2 for the data to be transmitted is performed by a pre-authenticated higher-level network  
3 management system.

1           51.    The system according to claim 1, wherein the step of determining current  
2 topology is performed via OSPF link state advertisements.

1           52.    The system according to claim 1, further comprising means for carrying  
2 said selected route in an IP datagram using an IP source route option.

1           53.    The system according to claim 1, further comprising means for carrying  
2 said selected route in packet payload.

1           54.    The system according to claim 1, wherein said selected route is specified  
2 as a series of nodes.

1           55.    The system according to claim 1, wherein said selected route is specified  
2 as a series of links.

1           56.    The system according to claim 1, wherein said selected route is specified  
2 as a series of nodes and links.

1           57.    The system according to claim 1, wherein said current topology and  
2 resources comprises:

3           a total number of active channels;

4           a number of allocated channels;

5           a number of preemptable channels;

6           a number of reserved restoration channels;

7           Shared Risk Links Groups throughout the reconfigurable optical network; and

8           optional physical layer parameters for each link.

- 1           58.    A system for lightpath provisioning in a reconfigurable optical network  
2 comprising:  
3           means for assigning an IP address to each network addressable element in said  
4 reconfigurable optical network;  
5           means for determining current resources in said reconfigurable optical network;  
6           means for determining current topology of said reconfigurable optical network;  
7           means for receiving a request to create a lightpath from a source;  
8           means for maintaining information regarding a state of said reconfigurable optical  
9 network;  
10          means for selecting a route for data to be transmitted between said source and a  
11 destination based on said current resources of said reconfigurable optical network and  
12 said current topology of said reconfigurable optical network;  
13          means for generating an API call to create a lightpath, said API call results in a  
14 message;  
15          means for forwarding said message to each network addressable element along  
16 said selected route;  
17          means for selecting an output channel at each node to be used as an input channel  
18 at a next node;  
19          means for reconfiguring an OLXC an input channel at a current node connected to  
20 said output channel at said current node;  
21          means for receiving a response from said destination that said selected route is not  
22 available; and  
23          means for releasing resources allocated along a partially created lightpath.

1           59.    The system according to claim 1, wherein said response is accomplished  
2           using an ICMP message.

1           60.    The system according to claim 1, wherein said response is accomplished  
2           using a CR-LDP message.

1           61.    The method according to claim 1, wherein said response is accomplished  
2           using a RSVP message.

1           62.    A system for lightpath provisioning in a reconfigurable optical network  
2           comprising:

3                means for naming each network addressable element in said reconfigurable  
4           optical network;

5                means for determining current topology in said reconfigurable optical network;

6                means for determining current resources in said reconfigurable optical network;

7                means for requesting establishment of a lightpath; and

8                means for allocating said lightpath.

1           63.    A method for removing a lightpath in a reconfigurable optical network  
2           comprising the step of explicitly forwarding a message to release said lightpath, said  
3           message initiated by a first-hop router.

1           64.    A method for removing a lightpath in a reconfigurable optical network  
2           comprising the steps of allowing said lightpath to be released by expiration as a result of  
3           a soft-state, wherein said soft-state fails to timely forward a message to create said  
4           lightpath in order to maintain said lightpath.

1           65.    A system for removing a lightpath in a reconfigurable optical network  
2           comprising means for explicitly forwarding a message to release said lightpath by a first-  
3           hop router.

1           66.    A system for removing a lightpath in a reconfigurable optical network  
2           comprising means for allowing said lightpath to be released by expiration as a result of a  
3           soft-state, wherein said soft-state fails to timely forward a message to create said  
4           lightpath in order to maintain said lightpath.

IDS 2000-0051